

# Data Collection System for the Dual-Carrier Exciter

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*A method was needed to monitor the dual-carrier exciter to be used at the 64-m-antenna deep space stations for the Viking 75 mission. The data collection system described in this article is to be used for diagnostic purposes to determine the status of the dual-carrier exciter. This system was developed to sample sequentially each analog test point in the dual-carrier exciter (mounted in the tricone of the 64-m antenna), digitally serialize each sample, send it over a single set of wires to the control room on the ground, convert the data from serial to parallel, and display the sampled data with digital displays or supply the sampled-data information to a computer for automatic monitoring of the dual-carrier exciter.*

## I. Introduction

The data collection system was developed for monitoring and diagnostic-analyzing the dual-carrier exciter assembly mounted in Module II of the tricone of the 64-m antenna. The system samples several test points, digitizes the data, serializes the data, and sends the data down on a single set of wires to the control room. The data are displayed and made available to a computer for diagnostic evaluation. The majority of the test points are analog voltages, but several status (digital) test points are also sampled.

## II. Description

The data collection system is divided into two sections. Sampling and digitizing is done in the first section (sampling and digitizing unit in Fig. 1). Ten 10-channel input

analog submultiplexers feed the analog signals into a 10-channel base multiplexer, thus giving a total of 100 analog channels. The multiplexers feed the analog signals, one at a time, into an analog-to-digital (A/D) converter.

The output of the A/D converter (12-bit, three-digit binary-coded decimal (BCD)) plus 12 discrete binary bits are serialized by the parallel-to-serial converter. The serialized data are amplified by the line driver, which feeds a twisted shielded wire pair that runs from the tricone to the receiving unit in the control room, a distance in excess of 305 m (1000 ft). The sequencing unit, a master timer, is used to select the correct analog signal from the input multiplexers to the base multiplexer and from the base multiplexer to the A/D converter. The sequencer then commands the A/D converter to convert and the parallel-to-serial shift registers to shift the data into serial format. The sequencer provides a sync and clock pulse to

be amplified by line drivers and transmitted down on two twisted shielded pairs to the receiver unit in the control room.

The second section (display unit in Fig. 1) is the display (visual or/and computer). The line receivers receive the data, sync and clock pulses, convert the data to single wire format, and feed the serial-to-parallel converter. The data are shifted into a 24-bit register by command of the clock. The 12-bit, three-digit BCD data are fed from the converter to the display, and the 12 discrete binary bits are used to indicate status. The BCD display uses light-emitting diode (LED) displays with built-in BCD for seven segment converters. The same outputs are available to a computer for diagnostic analysis of the dual carrier.

At the time the data enter the serial-to-parallel converter, the sync and clock pulses are fed to the bit/word counter (two divide-by-10 counters). The output of the counter is fed into the readout sequencers. The readout sequencer consists of a series of gates that selects the appropriate display and times the latching of the data into the display. Each readout sequencer unit can handle ten displays, and the bit word counter can supply ten readout sequencing units, giving a total display capability of 100. The bit/word counter uses the sync to synchronize the data with the commands from the readout sequencer to the display.

The data collection system will be used to gather the transmitter (400-kW DSN, 450-kW radar, and 400-kW X-band radar) parameters (temperature, flow, power meter readings, voltages) and send this information down to the control room for display. This information will also be used to calculate the actual power dissipation in different parts of the klystron, using the arithmetic processing unit (Ref. 1), which will be displayed with the other transmitter data.

### III. Performance

The data collection system as a prototype unit was installed along with the prototype dual-carrier exciter at DSS 14. It has been in operation for one year with few problems.

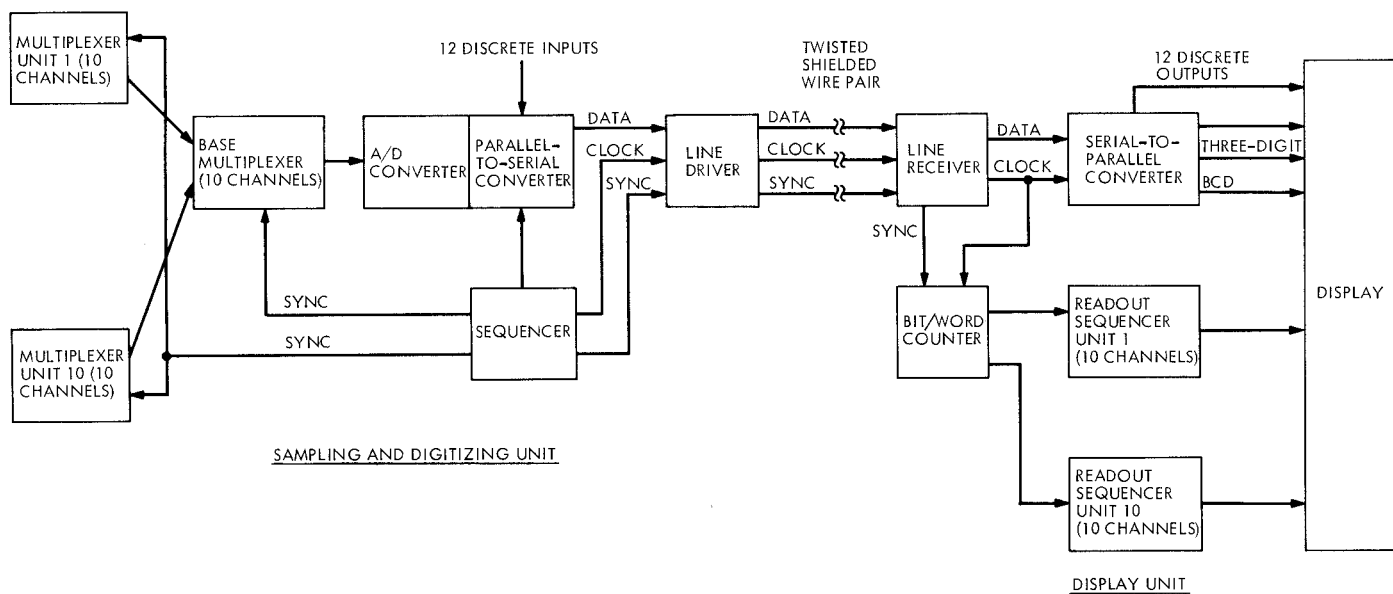
The display unit mounted in the control room shows the power levels at each stage in the two multipliers, amplifiers, and switching chains and shows the dual-carrier exciter switching configuration and the power supply voltages. This has proved to be very helpful to operating personnel in determining the exciter configuration and exciter problems. The line drivers and receivers are operating over a system of twisted shielded wire pairs in excess of 305 m (1000 ft), with sections of unshielded wires running up to 9.1 m (30 ft). There has been no indication of interference from outside noise sources.

### IV. Concluding Remarks

The data collection system has been proven to work within the environment of the 64-m antennas and deliver useful information from the dual-carrier exciter in the tri-cone down to the control room. This system is being expanded to gather additional data from the high-power transmitter. These additional data will include the input and output temperatures and the flow rate of the water for the cooling of the klystron. These data will be displayed at the transmitter control rack. A small calculator will be used to calculate automatically and display the power dissipation within the klystron. This information will give a clear understanding of the klystron's condition and a calometer output power reading in real time. These data, plus other data, will be furnished to a computer for diagnostic analysis of the high-power transmitter's condition.

## Reference

1. McPeak, W. L., "Arithmetic Processing Unit," in *The Deep Space Network Progress Report for March and April 1973*, Technical Report 32-1526, Vol. XV (this issue). Jet Propulsion Laboratory, Pasadena, Calif., June 15, 1973.



**Fig. 1. Data collection system**